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## Biochemical Study for The Effect of Pfizer-BioNTech COVID-19 Vaccine

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### ABSTRACT

The present study aimed to evaluate the biochemical effect of COVID-19 vaccines (Pfizer-BioNTech COVID-19 vaccine). 90 samples were included in the study from people in the vaccine center in Al-Dhuluiya general hospital-Salah Al-Din who was vaccinated with the Pfizer vaccine during the period from 1/11/2021 until 1/2/2022. The samples were collected before receiving the 1st dose and after 24-48 hours of taking the 1st and 2nd doses. The collected samples were divided into three groups: -First group-G1: Before taking the first dose of the Pfizer vaccine, -Second group-G2, and Third group-G3: After taking the first and second doses of the Pfizer vaccine respectively. The study includes the determination of different biochemical parameters such as serum Troponin, Lactate dehydrogenase-LDH, D-dimer, Lipid profiles (Cholesterol, Triglycerides, High-density lipoprotein cholesterol-HDL-C, Low-density lipoprotein cholesterol-LDL-C), Total iron, Transferrin, ferritin, Glutathione-GSH, Malondialdehyde-MDA, and peroxy nitrate-PON.

The results showed that LDH, D-dimer, and MDA levels were significantly elevated after the first and second doses of the Pfizer vaccine as compared with their levels before receiving doses vaccine. While the level of troponin, lipid profile, total iron, and transferrin didn't show any significant difference after vaccination as compared with their levels before receiving the vaccine. So, we can conclude that the vaccination with the Pfizer-BioNTech COVID-19 vaccine may affect the cardiac marker and the oxidative stress state.

### INTRODUCTION

In Wuhan (China) in December 2019 first identified a novel coronavirus-recently named SARS-CoV-2, which causes a disease named COVID-19 or Coronavirus disease 2019, which then pandemic worldwide and affected all territories and countries (Wang *et al.*, 2020; Sintema., 2020). The infections with coronavirus in humans may be asymptomatic or can cause cough, illnesses, fever, gastrointestinal irritation, and shortness of breath (Huang *et al.*, 2020; Gupta *et al.*, 2020). The coronavirus infection may lead to severe pneumonia and death, especially in immune-compromised individuals and the elderly (Sharma *et al.*, 2021). Since the beginning of the pandemic, enormous efforts have been directed to find effective vaccines and safe ones, and those efforts culminated in finding 184 COVID-19 vaccines in July 2021 nominees in pre-clinical development. These vaccines involve viral vectors, protein-based vaccines, the whole virus inactivated or live attenuated, and nucleic acid vaccines.

The vaccination supply hopes for an end to the pandemic in all countries around the world (Ndwandwe and Wiysonge., 2021).

On 11/11/2020 the Administration of Food and Drugs issued authorization to use the Pfizer-BioNTech COVID-19 vaccine in an emergency to prevent the prevalence of COVID-19, which has been given in two doses discrete by 21 days (Oliver *et al.*, 2020). The most ordinary symptoms after vaccination with the Pfizer vaccine include headaches, pain in the injection site, fever, tiredness, and mild flu-like symptoms while fast heartbeat, joint pain, drowsiness, aches in the body, chills, and difficulty breathing were less common symptoms as a side effect of the vaccine (El-Shitany *et al.*, 2021), and also some rare side effects were reported after vaccination with the 1st dose of Pfizer vaccine such as acute kidney injury and nephrotic (increase the concentration of serum creatinine) (Lebedev *et al.*, 2021), myocarditis after 2<sup>nd</sup> dose (Viskin *et al.*, 2021; Marshall *et al.*, 2021; Chatterjee *et al.*, 2021; Aye *et al.*, 2021 ) and acute Myocardial Infarction within twenty-two hours after the 1<sup>st</sup> dose (Aye *et al.*, 2021; Sung *et al.*, 2021; Jabagi *et al.*, 2022 ). So many people all over the world have anxiety about the side effect of vaccines. Thus, the present study was conducted to evaluate the side effects of the Pfizer vaccine.

## MATERIALS AND METHODS

### Subjects and Study Design:

Ninety serum and plasma samples were collected from people in the vaccine center in Al-Dhuluiya general hospital-Salah Al-Din which vaccinated with the Pfizer-BioNTech COVID-19 vaccine approved by the Iraqi ministry of health during the period from 1/11/2021 until 1/2/2022 with age ranged from 18-55 years. The samples were collected before receiving the 1st dose and

after 24-48 hours of taking the 1st and 2nd doses. The collected samples were divided into three groups:

-First group-G1: Before taking the first dose of the Pfizer vaccine.

-Second group-G2: After taking the first dose of the Pfizer vaccine.

-Third group-G3: After taking the second dose of the Pfizer vaccine.

The study includes the determination of serum Troponin (McNeil., 2007), Lipid profiles (Cholesterol, Triglycerides, High-density lipoprotein cholesterol-HDL-C, Low-density lipoprotein cholesterol-LDL-C), Total iron-TI (Garcie., 1979), Transferrin, ferritin (Worwood., 1986), Glutathione-GSH (Sedlak and Lindsay., 1968), Malondialdehyde-MDA and peroxy nitrate-PON (Abi., 1974) concentration and also serum Lactate dehydrogenase-LDH activity (Vassiault, 1986) and plasma D-dimer concentration (Kaplan & Pesce., 1989) by using standard methods.

### Statistical Analysis:

The results were analyzed by using SPSS V.25 using the completely randomized design method through the Duncan test for identifying the variance between groups under investigation at probability  $p \leq 0.05$ .

## RESULTS

### Levels of Serum Cardiac Indicator and Plasma D-dimer

The results of troponin, LDH, and D-dimer obtained from the current study were summarized in Table 1.

Table 1 showed that the activity of LDH and D-dimer levels significantly elevated at probability  $p \leq 0.05$  in G1 and G2 after taking the vaccine as compared with the group before taking vaccine G1, with no significant difference in troponin after and before vaccination.

**Table 1:** Mean±Standard deviation of the level of Troponin, D-dimer and LDH activity before and after taking the vaccine.

Parameters	G1	G2	G3
Troponin (ng/ml)	0.019±0.009 a	0.024±0.012 a	0.020±0.007 a
LDH (U/L)	234.93±56.065 b	299.80±72.531 a	296.22±74.140 a
D-dimer (mg/dl)	178.97±64.568 b	269.37±143.362 a	235.33±96.973 a

**Levels of Serum Lipids:**

The study also includes an evaluation of the serum levels of lipid profile in sera of samples under investigation before and after taking of vaccine, the results obtained from the current study were summarized in Table

2.

No significant difference in the level of serum lipid profile at probability  $p \leq 0.05$  was shown in Table 2 between groups after vaccination as compared with G1 before taking the vaccine.

**Table 2:** Mean±Standard deviation of serum lipid profile level before and after taking the vaccine.

Parameters	G1	G2	G3
Cholesterol (mg/dl)	152.97±38.400 a	141.27±34.372 a	137.00±38.460 a
Triglycerides(mg/dl)	170.37±86.744 a	158.83±92.590 a	163.74±94.033 a
HDL-C(mg/dl)	42.03±6.494 a	39.53±5.283 a	40.93±4.463 a
LDL-C(mg/dl)	67.27±27.483 a	71.13±28.352 a	73.67±28.866 a

**Levels of Serum Iron Indicator:**

The level of ferritin was significantly elevated in G3 as compared with its level in G1 and G2, with no significant difference in

the levels of total iron and transferrin after taking 1st and 2nd dose of the vaccine as compared with their levels before taking the vaccine, Table 3.

**Table 3:** Mean±Standard deviation of Total iron, Transferrin and Ferritin levels before and after taking the vaccine.

Parameters	G1	G2	G3
Total iron (µg/dl)	85.89±38.575 a	67.86±38.595 a	70.35±36.054 a
Transferrin (µg/dl)	348.33±77.505 a	347.80±61.819 a	310.19±67.423 a
Ferritin (µg/dl)	18.19±8.115 b	21.19±10.756 b	32.29±19.094 a

**Levels of Antioxidant Parameters in Serum:**

The study also evaluates the oxidative stress state after administration of vaccine doses, the results showed that the level of glutathione significantly decreased after taking the doses of vaccine with increasing

the level of MDA as compared with the group before taking the vaccine, while the level of peroxynitrite significantly increased in groups taking the first dose of vaccine and slightly increased in G2(Non-significant increased) as shown in Tabl

**Table 4:** Mean±Standard deviation of GSH, MDA and PON levels before and after taking the vaccine.

Parameters	G1	G2	G3
GSH (mole/L)	3.607±1.2904 a	2.503±1.1095 b	2.256±0.9674 b
MDA (mole/L)	53.50±23.008 b	69.21±29.285 a	78.62±33.001 a
PON (mole/L)	118.17±57.272 b	157.24±68.675 a	149.73±66.463ab

## DISCUSSION

The results of the current study showed that the level of troponin was not affected by the Pfizer vaccine, this result was in disagreement with the finding of (Acharya *et al.*, 2021) which indicates that the level of troponin significantly elevated among Pfizer vaccinators, and they interpreted this increase to the inflammatory and immune response to mRNA vaccine which may be cause myocarditis as one of the conformed side effects of Pfizer vaccine (Marshall *et al.*, 2021; Aye *et al.*, 2021). The increase in LDH activity in the present study may be a marker for myocarditis, and this result agreed with the finding of (Fatima *et al.*, 2022) who indicated that the activity of LDH significantly elevated in sera of individuals who take Pfizer vaccinators. In addition, (Smadja *et al.*, 2021) showed that the level of d-dimer was significantly elevated in the plasma of people who received doses of the Pfizer vaccine, these results agree with the finding of the current study, and this finding indicates that elevated level of D-dimer represents one of the side effects of Pfizer vaccine which activate the coagulation pathways.

The study also includes evaluating the effect of the Pfizer vaccine on the level of lipid profile, and the results showed that the vaccination didn't affect the concentration of lipids, this finding was agree with the finding of (Davido *et al.*, 2021). Also, the level of total iron and Transferrin was not affected after vaccination, and this finding was agreed with the finding of (Singh *et al.*, 2021) who indicated that the vaccine did not affect the level of total iron. While the elevated level of ferritin after receiving the second dose of the vaccine may be due to iron loss by lack of iron consumption or bleeding or other reasons (Worwood., 1990). The elevated the level of MDA and PON with reducing in the level of antioxidants represent in GSH in the present study indicate that vaccinations under oxidative stress, in which the antioxidants in the cells such as glutathione run out in removing the toxic materials in the cells such

as peroxides or free radicals and improve the immune system and prevent the oxidative processes in the body (Horowitz *et al.*, 2020).

The infection with Coronavirus may be affected by many biochemical parameters such as D-dimer, transferrin, MDA, ferritin, lipid profile, LDH which are significantly elevated, with a significant reduction in the level of total iron and GSH, (Kadhim *et al.*, 2022, July; Kadhim *et al.*, 2022, November; Al-Samarra & Al-Samarrai, 2022, July; Szarpak *et al.*, 2022; Kadhim *et al.*, 2022; Al-Samarra & Al-Samarrai, 2022; Mahat *et al.*, 2021). So, the interactions between the change (increasing or decreasing) in the level of the parameters under investigation in sera of infected patients with COVID-19 and also the same change in vaccination individuals may be increased anxiety about the side effect of vaccines.

## Conclusion:

From the results of the present study, we can conclude that the Pfizer vaccine may have some side effects on the cardiac and oxidative stress state.

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